



REAR TRANSITION MODULE
ATCA-5400

Revision history

Version	Date	Description
-0000	August 2009	First edition.
-0001	August 2010	Second edition. Sensor threshold changes and additional supported products.
-0002	October 2010	Third edition. Revised OOS LED description; added ATCA-4555 as a compatible CPM.
-0003	December 2010	Fourth edition. Sensor threshold change; added warning about installing from incompatible upgrade files; use only shielded serial and Ethernet cables.
-0004	March 2011	Fifth edition. Added <i>Enabling the secondary RTM SAS ports for RTM RAID</i> section; updated managed sensor threshold values in Table 15.
-0005	October 2011	Sixth edition. Added the <i>Get Self Test Results</i> IPMI command.
-0006	December 2011	Seventh edition. See What's new in this manual on page 5 for change information.

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Preface

About this manual

This manual describes the ATCA-5400, a rear transition module (RTM) that is fully compliant with AdvancedTCA® (PICMG 3.0 Advanced Telecommunications Computing Architecture R3.0). The RTM is designed to mate with a compatible front module, such as the ATCA-4500, ATCA-4550, and ATCA-4555 Compute Processing Module, in high availability (HA) Radisys platform systems.

Use this manual as a reference for the operation and maintenance of the RTM. The material presented here is not introductory; it is assumed that you are already familiar with the intended use of the RTM in your organization's ATCA platform.

For instructions on installing optional components into the RTM, see [Chapter 2, Installing FRUs, on page 10](#). For instructions on installing the RTM into the shelf, see the *ATCA-4500, ATCA-4550, ATCA-4555 Compute Processing Module Installation Guide*.

The simplified name of "RTM" will be used in place of "ATCA-5400" for the rest of the manual. The simplified name of "CPM" will be used in place of "Compute Processing Module" or "ATCA-4500" or "ATCA-4550" or "ATCA-4555" for the rest of the manual.

What's new in this manual

This version of the ATCA-5400 RTM Reference has been updated with the following changes:

- Changed the UNR threshold value to 3.60V for the +3.3V sensor

For additional information about new features, resolved issues and known limitations, refer to the product release notes.

Where to get more product information

Please visit the Radisys Web site at www.Radisys.com for product information and other resources. Downloads (manuals, release notes, software, etc.) are available at www.Radisys.com/downloads.

The following manuals are available to help you use the RTM and the CPM:

- **Installation and initial setup instructions.** The *ATCA-4500, ATCA-4550, ATCA-4555 Compute Processing Module Installation Guide* provides the steps for installing the CPM and RTM into a shelf and completing the initial configuration.
- **Hardware reference information.** The *ATCA-4500, ATCA-4550, ATCA-4555 Compute Processing Module Reference* describes the module's hardware features and operation. It also contains information on the main BIOS configuration, Intelligent Platform Management Interface (IPMI) commands, and troubleshooting.

Preface

About related Radisys products

The RTM is part of the Radisys product family. For information on this product family and other Radisys products, see the Radisys Web site at www.Radisys.com.

Standards information

For information about the PCI Industrial Computer Manufacturers Group (PICMG®) and the AdvancedTCA standard, consult the PICMG Web site at this URL: <http://www.picmg.org>.

Related documents

CAN/CSA C22.2 No. 60950-1-03 Safety for Information Technology Equipment, Version 2, Canadian Standards Association (www.csa.ca), April 1, 2003

EN 60950-1:2002 Information Technology Equipment. Safety. General Requirements, European Committee for Electrotechnical Standardization (CENELEC) (www.cenelec.eu), February 22, 2002

IEC 60950-1 Information Technology Equipment - Safety - Part 1: General Requirements, 1st Edition, International Electrotechnical Commission (www.iec.ch), October 25, 2001

Information Technology - Serial Attached SCSI - 1.1 (SAS-1.1), ANSI/INCITS 417-2006

Integrated RAID for SAS User's Guide, LSI Logic® Corporation

LSISAS1064E PCI Express to 4-Port Serial Attached SCSI, LSI SAS1064E Revision 2.3, LSI Logic Corporation, November 2007

Intelligent Platform Management Interface Specification v1.5, Revision 2.0, Intel Corporation; Hewlett Packard Company, NEC Corporation, and Dell Computer Corporation

PICMG 3.0 Advanced Telecommunications Computing Architecture R3.0, PCI Industrial Computer Manufacturers Group, March 24, 2008

PICMG 3.1 R1.0 Specification, Ethernet/Fibre Channel for AdvancedTCA Systems, PICMG, January 22, 2003

PICMG AMC.0 R2.0 Advanced Mezzanine Card Base Specification, PCI Industrial Computer Manufacturers Group, November 15, 2006

PM8380 QuadSMX 3G Quad SATA/SAS Mux/Demux for 3G, PMC-2031101, Issue 8, PMC-Sierra, April 2005

Serial ATA Revision 2.5, Serial ATA International Organization, October 27, 2005

Small Form-factor Pluggable (SFP) Transceiver Multisource Agreement (MSA), Cooperation Agreement for Small Form-Factor Pluggable Transceivers, Agilent Technologies, Blaze Network Products, E2O Communications, Inc., ExcelLight Communications, Finisar Corporation, Fujikura Technology America Corp., Hitachi Cable, Infineon Technologies Corp., IBM Corp., Lucent Technologies, Molex, Inc., Optical Communication Products, Inc., Picolight, Inc., Stratos Lightwave, and Tyco Electronics, September 14, 2000

Preface

UL 60950-1 Safety for Information Technology Equipment – Part 1: General Requirements, Edition 1, Underwriter Laboratories (www.ul.com), April 1, 2003

Notational conventions

This manual uses the following conventions

BoldText	A keyword.
<i>ItalicText</i>	File, function, and utility names.
<code>MonoText</code>	Screen text and syntax strings.
BoldMonoText	A command to enter.
<i>ItalicMonoText</i>	Variable parameters.
Brackets []	Command options.
Curly braces { }	A grouped list of parameters.
Vertical line	An “OR” in the syntax. Indicates a choice of parameters.

All numbers are decimal unless otherwise stated.

Electrostatic discharge

WARNING! This product contains static-sensitive components and should be handled with care. Failure to employ adequate anti-static measures can cause irreparable damage to components.

Electrostatic discharge (ESD) damage can result in partial or complete device failure, performance degradation, or reduced operating life. To avoid ESD damage, the following precautions are strongly recommended.

- Keep each module/PCB in its ESD shielding bag until you are ready to install it.
- Before touching a module, attach an ESD wrist strap to your wrist and connect its other end to a known ground.
- Handle the module only in an area that has its working surfaces, floor coverings, and chairs connected to a known ground.
- Hold modules only by their edges and mounting hardware. Avoid touching PCB components and connector pins.

For further information on ESD, visit www.esda.org.

Product Overview

This chapter briefly describes the ATCA-5400 RTM.

RTM overview

The ATCA-5400 RTM is an optional compatible rear transition module for the ATCA-4500, ATCA-4550, and ATCA-4555 CPM front module that supplies the CPM with additional data storage and connectivity options.

The RTM has an on-board SAS/SATA controller and can host an optional SAS hard disk drive (HDD). The controller can access an HDD AMC if one is installed on the CPM. The RTM also includes two rear panel SAS ports to allow cable connections to additional hard disk drives, such as hard disk drives accessible from another RTM. The SAS/SATA controller supports RAID (redundant array of inexpensive disks), including RAID 0 (striping) and RAID 1 (mirroring) configurations.

For instructions on installing a hard disk drive, see [Installing a hard disk drive on page 11](#). For instructions on configuring a RAID, see [Chapter 3, Configuring a Redundant Disk Array, on page 14](#).

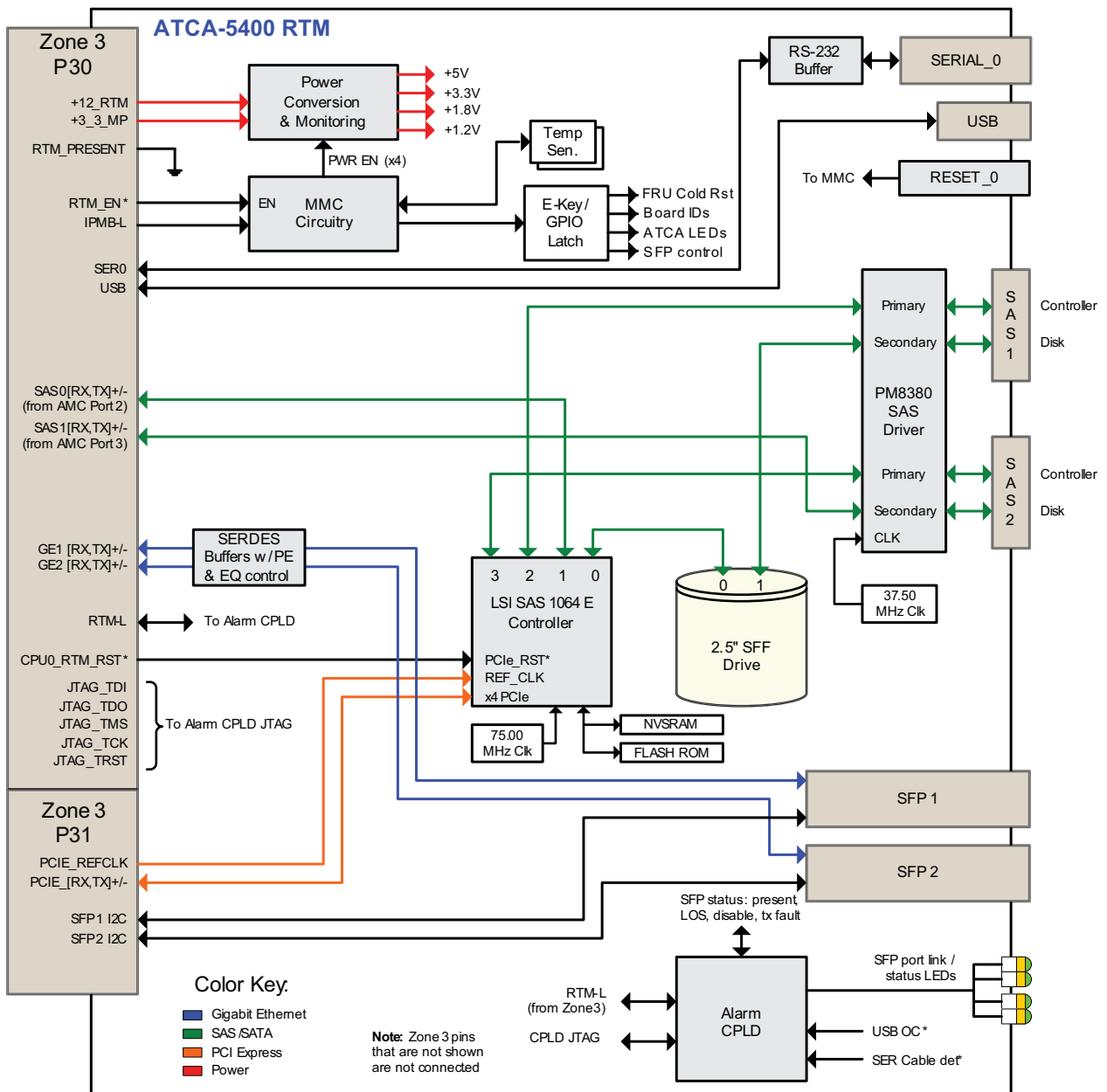
The RTM has two 1-gigabit Ethernet SFP sockets on its face plate that can facilitate external connections through the RTM to the CPM. These rear Ethernet ports are usable when the Ethernet controller on the CPM is configured through a BIOS menu setting to route the connections to the RTM. For instructions on installing SFP transceivers in the SFP sockets, see [Installing SFPs on page 10](#).

The RS-232 serial port on the RTM provides a management interface to the CPM. The RTM also includes a USB 2.0 port that connects to the CPM.

A module management controller (MMC) provides intelligent management of the RTM hardware, including its managed sensors. The MMC responds to reset signals from the CPM as well as IPMI commands.

Block diagram

Figure 1. ATCA-5400 RTM block diagram



Installing FRUs

Installing SFPs

The RTM has sockets that accept SFP (small form-factor pluggable) transceiver modules. These modules provide external connections to the Ethernet interfaces, and they can be installed on the RTM at any time. The sockets are located on the face plate of the RTM, as shown in [Figure 4 on page 19](#).

Configuration recommendations

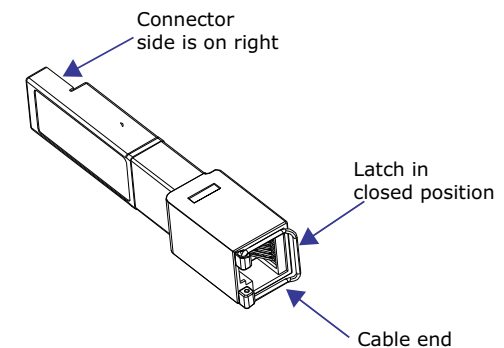
The RTM supports up to two SFP transceivers. Standard RTM configurations come with SFP filler plugs installed in unused sockets to protect the internal RTM components. For a list of tested and qualified transceivers, see the *Component Compatibility Report* in the AdvancedTCA downloads section of the Radisys Web site at www.Radisys.com/downloads.

Transceiver installation

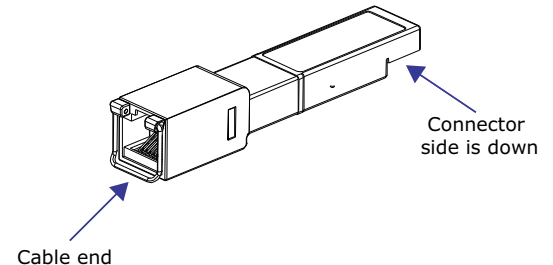
The illustration shows the correct orientation for inserting an SFP transceiver. The transceiver may vary in appearance, but the same insertion guidelines should be used.

1. Obey the ESD procedures in [Electrostatic discharge on page 7](#) to make sure you are adequately grounded.
2. Remove the RTM and the transceivers from their antistatic bags.
3. On the RTM face plate, remove the filler plugs from the sockets where the transceivers will be installed. For sockets not being used, keep the filler plugs in place. The plugs protect the sockets, control airflow, and prevent electromagnetic interference.
4. Make sure the latch on the cable end of the transceiver is closed. This makes the SFP snap into position when it is inserted into the socket.
5. Hold the transceiver near the cable end and turn the connector side to the correct position depending on the RTM orientation:
 - If the RTM is vertical, turn the transceiver so the connector side is on the right.
 - If the RTM is horizontal, turn the transceiver so the connector side is down.

Vertical insertion



Horizontal insertion



6. Insert the connector end of the transceiver into the socket.
7. Once inserted into the socket, carefully slide the transceiver until its connector is fully seated and the SFP snaps into position.
8. Repeat the previous steps for each transceiver being installed.
9. For transceivers with cable plugs installed on their cable end, keep the plugs in place until it is time to connect cables to the transceivers. The cable plugs protect the internal components of the transceivers from dust and foreign contaminants.

Note: If an SFP needs to be removed, open the latch and pull the SFP out of the socket.

Filler plug installation

If the SFP transceivers are removed, install either replacement transceivers or filler plugs to protect the sockets, control airflow, and prevent electromagnetic interference.

Installing a hard disk drive

Radisys ships the RTM without a hard disk drive (HDD) installed. A separate HDD can be ordered from Radisys and installed onto the RTM prior to installing the RTM into the shelf. For information on suitable hard disk drives, see the *Component Compatibility Report* in the AdvancedTCA downloads section of the Web site at www.Radisys.com/downloads.

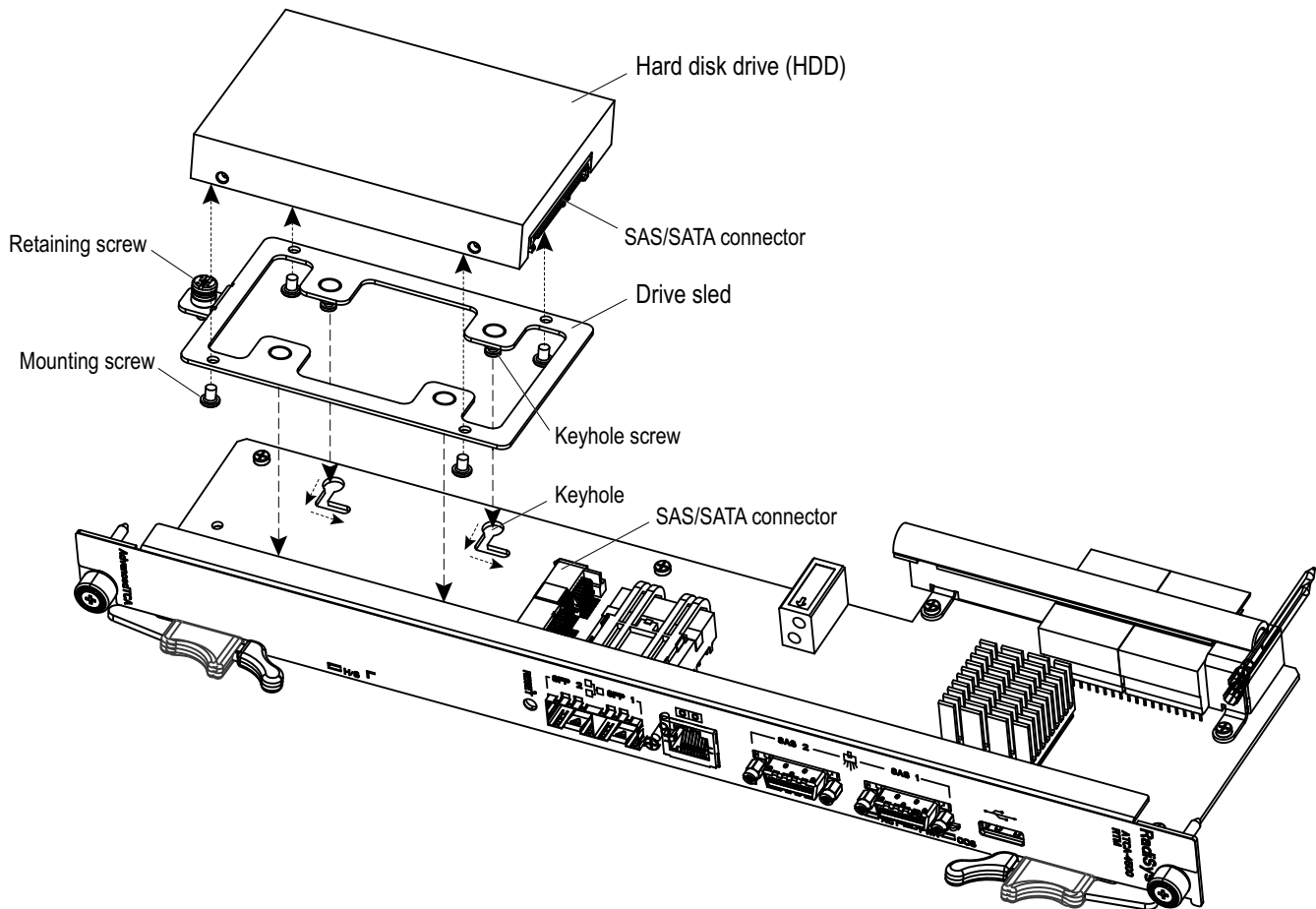
The RTM ships with a sled for sliding the HDD into the correct mounting position on the RTM (see [Figure 2 on page 12](#)). To install the HDD on the RTM, first attach the HDD to the drive sled with the provided screws and then mount the sled and HDD onto the RTM. The following sections explain the installation procedure.

Before starting: Get a medium-size Phillips screwdriver and a suitable HDD.

Attaching the drive sled to the HDD

1. Obey the ESD grounding procedures in [Electrostatic discharge on page 7](#).
2. Place the drive sled on a static-free surface with the retaining screw at the left (screw head up). See [Figure 2 on page 12](#).
3. Place the hard disk drive (HDD) component side down on the drive sled with the HDD SAS/SATA connector at the right.
4. Hold the HDD and drive sled together. Turn them upside down to access the screw holes.
5. Screw the four supplied M3 screws through the sled holes shown in [Figure 2 on page 12](#) and into the corresponding holes on the HDD.
6. Turn the HDD and drive sled right-side up so the retaining screw head faces up.

Figure 2. HDD installation



Mounting the hard disk drive and sled onto the RTM

1. Align the four sled keyhole screws over the RTM keyholes and simultaneously guide all four screws down into the keyholes.
2. Slide the sled along the keyhole slot toward the RTM face plate and then toward the RTM SAS/SATA connector. See [Figure 2](#). The hard disk drive SAS connector mates with the RTM SAS/SATA connector.
3. Secure the sled to the RTM by tightening the retaining screw with a screwdriver.

Inserting the RTM into the chassis

After the hard disk drive is installed, insert the RTM into the chassis in the rear slot corresponding to the associated front module CPM.

Updating the drive information record

If you are installing a new hard disk drive or replacing an existing one, use the *rmcpta* command to ensure the drive information record for the MMC has the correct hard disk drive type when the RTM resets after it is inserted into the chassis.

Important: To ensure compatibility with the commands in this procedure, use the version of *rmcpta* that is provided with the latest Radisys software release.

1. Invoke *rmcpta*, specifying the Shelf Manager IP address:

```
rmcpta -h <ShMgr IP address>
```

2. Set the controller address where messages are forwarded, specifying the front module slot IPMB address and the IPMB-L address of the RTM:

```
targetfwd <Front module slot IPMB address> <RTM IPMB-L address>
```

3. Update the drive information record in the FRU data with data about the new hard disk drive to be installed.

```
setdriveinfo
```

4. The *setdriveinfo* command prompts you to complete the following fields:

```
Enter the number of drives installed ( ): 1
```

```
Enter the drive type, 0 - FC, 1 - SATA, 2 - SAS, 0xFF - None (0xFF): 2
```

```
Enter drive manufacturer name ( ):
```

```
Enter drive model ( ):
```

```
Enter drive serial number ( ):
```

```
Enter the desired number of custom info fields ( ): 0
```

The entered information is displayed to verify the entries:

```
# Radisys Record ID      = 0x0A Drive Information Record
# Record Format Version  = 0x00
# Drive Number 1
#   Drive Type           = SAS (0x02)
#   Manufacturer Name    =
#   Model                 =
#   Serial Number        =
```

Write the data to the device by entering **yes**:

```
Write the data to the device? [yes/no] yes
```

```
Writing the data back to the device FRU 0 information area...
```

```
Detected support of Radisys OEM Group Write FRU Data command. (0x2E 0x0A)
```

The MMC now reports the correct drive type.

Configuring a Redundant Disk Array

This chapter explains the RTM's support for RAID (redundant array of inexpensive disks) and how to configure a RAID from the available hard disk drives. Hard disk drive arrays can be configured in the SAS BIOS, which is the BIOS for the SAS/SATA controller. Some hard disk drives must be connected to the RTM with cables before you can include them in an array.

Supported RAID configurations

The RTM's SAS/SATA controller supports these RAID levels and configurations:

- **RAID 1 integrated mirroring (IM)**, which provides redundancy. Two hard disk drives (a primary and secondary) must be identified to be used as exact copies. Up to two hot spare hard disk drives can be included in case one of the copied hard disk drives fails. In case of failure, the contents of the remaining good hard disk drive can be copied to a hot spare, which also gets a copy of all new data. The available hard disk drive capacity is the same as the smallest hard disk drive or spare in the array.
- **RAID 1 integrated mirroring enhanced (IME)**, which provides striping and one copy of each stripe for redundancy. At least 3 hard disk drives must be used, with a maximum of 8 copies. Up to two hot spare hard disk drives can be included in case one of the participating hard disk drives fails. The available hard disk drive capacity is the smallest disk capacity in the array multiplied by the number of hard disk drives in the array, and then divided by two. This is due to the mirrored stripes used in the IME array.
- **RAID 0 integrated striping (IS)**, which improves performance. At least 3 hard disk drives must be identified to participate, with a maximum of 10 hard disk drives. The available hard disk drive capacity is the capacity of the smallest hard disk drive in the array multiplied by the number of hard disk drives in the array.

The SAS/SATA controller supports multiple arrays at once, including arrays of different types, as long as the number of available hard disk drives is sufficient to support the arrays. For additional information on the supported RAID options, see the [Integrated RAID for SAS User's Guide](#) from LSI Logic Corporation.

Preparing hard disk drives to participate in an array

Table 1 identifies the locations of hard disk drives that can be used by the RTM SAS/SATA controller in an array. It also shows the physical SAS connection that must be present before you can include the hard disk drive in an array through a SAS BIOS configuration.

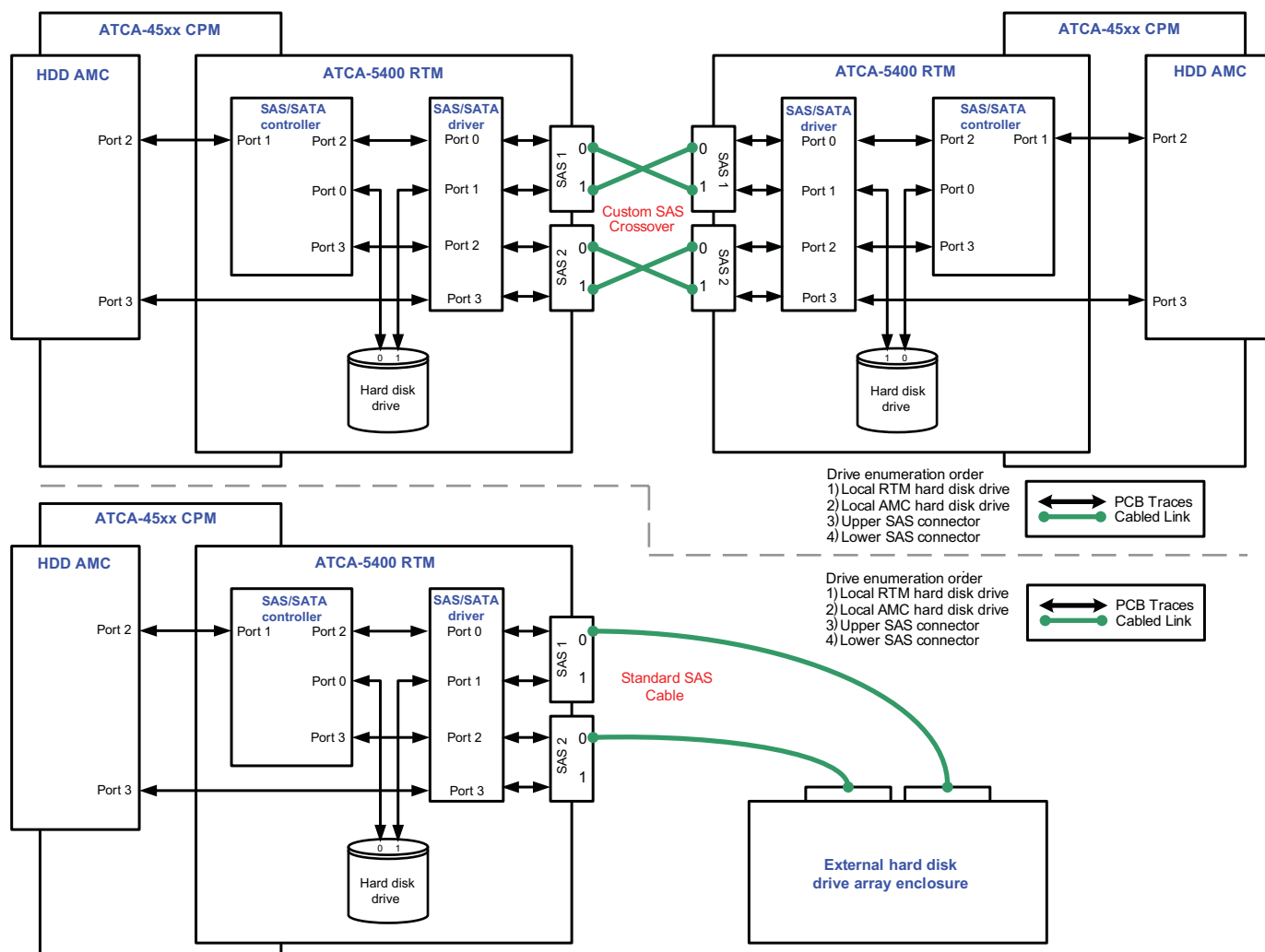
Table 1. Locations and SAS connections for eligible disks

Disk location	Connection to the RTM SAS/SATA controller
RTM (with its SAS/SATA controller hosting the RAID)	On board (no action required)
HDD AMC on a CPM in the front slot hosting the RTM	Zone 3 connectors (no action required)
Another ATCA-5400 RTM	Custom cable between the SAS 1 ports on each RTM (see Figure 3 on page 16)
HDD AMC on another CPM	Custom cable between the SAS 2 ports on each RTM (see Figure 3 on page 16)
Any other hard disk drive or hard disk drive array that can be connected to the RTM with a cable	Cable from the hard disk drive or hard disk drive array to a SAS port on the RTM

Tip: Before configuring an array in the SAS BIOS, make a copy of any existing data on the hard disk drives. All existing data is deleted from the hard disk drives that participate in an IS array. For a hard disk drive that will act as the primary hard disk drive in an IM or IME array, the SAS BIOS configuration gives you the option to keep existing data on the hard disk drive. For other hard disk drives in an IM or IME array, any existing data is deleted.

In [Figure 3](#), the top illustration shows the connections between hard disk drives on two RTMs and the CPMs in the front slots. The bottom illustration shows the connections between a hard disk drive array and hard disk drives on the RTM, with the CPM in the front slot.

Figure 3. Connections between hard disk drives on two ATCA-5400 RTMs or to a hard disk drive array



Enabling the secondary RTM SAS ports for RTM RAID

This procedure describes how to enable the secondary SAS ports on an ATCA-5400 RTM so an RTM-to-RTM RAID connection can be configured using a custom SAS cable.

Installing a hard disk drive

To configure RAID between two RTMs, a SAS hard disk drive must be installed in both RTMs so the secondary ports will function. A SAS drive is dual-ported and can be accessed by more than one controller, while a SATA drive is single-ported.

Follow the steps in [Installing a hard disk drive on page 11](#), but do not perform the final procedure [Updating the drive information record on page 13](#). Instead, perform the following procedure to enable the SAS ports as part of the drive update process.

Updating the drive information record to enable the secondary ports

Use the *rmcpta* command to ensure the drive information record for the MMC has the correct hard disk drive type when the RTM is powered up in the chassis.

Important: To ensure compatibility with the commands in this procedure, use the version of *rmcpta* that is provided with the latest Radisys software release.

1. Invoke *rmcpta*, specifying the Shelf Manager IP address:

```
rmcpta -h <ShMgr IP address>
```

2. Set the controller address where messages are forwarded, specifying the front module slot IPMB address and the IPMB-L address of the RTM:

```
targetfwd <Front module slot IPMB address> <RTM IPMB-L address>
```

3. Update the drive information record in the FRU data with data about the new hard disk drive to be installed.

```
setdriveinfo
```

4. The *setdriveinfo* command prompts you to complete several data fields.

Note: To enable the secondary SAS ports on the SAS1 and SAS2 connectors, enter **1** when prompted to specify the number of custom info fields, then enter **EN** when prompted to specify the value for the custom info field. Refer to the following configuration example.

```
Enter the number of drives installed ( ): 1
```

```
Enter the drive type, 0 - FC, 1 - SATA, 2 - SAS, 0xFF - None (0xFF): 2
```

```
Enter drive manufacturer name ( ):
```

```
Enter drive model ( ):
```

```
Enter drive serial number ( ):
```

```
Enter the desired number of custom info fields ( ): 1
```

```
Enter drive custom 1( ): EN
```

```
Write the data to the device by entering yes:
```

```
Write the data to the device? [yes/no] yes
```

Configuring a hard disk drive array in the SAS BIOS

The SAS BIOS can be accessed during the CPM's boot process, before the main BIOS prompt appears.

To configure a RAID:

1. Reset the CPM.
2. From the CPM serial console, access the SAS BIOS when you are prompted to press Ctrl-C to start the LSI configuration utility.
3. The SAS/SATA controller is shown. Select it and press Enter.
4. Select the RAID Properties option and press Enter.

5. Select the option for the type of RAID to create:

- a. Select Create IM Volume to set up a RAID 1 mirroring volume.

Select two RAID hard disk drives to act as the primary and secondary mirror hard disk drives, and optionally up to two hot spares in case the primary or secondary fails.

The first hard disk drive you select is the primary hard disk drive, which allows the option to keep existing data. Data on a secondary hard disk drive is deleted.

- b. Select Create IME Volume to set up a RAID 1E volume for mirroring with enhancements.

Select at least three RAID hard disk drives to participate in the array, and up to two hot spares in case a participating hard disk drive fails.

The first hard disk drive you select is the primary hard disk drive, which allows the option to keep existing data. Data on each secondary hard disk drive is deleted.

- c. Select Create IS Volume to set up a RAID 0 striping volume.

Select at least 3 hard disk drives to include in the array, with a maximum of 10. Data on each hard disk drive in a striping array is deleted.

Note: When two pairs of RTMs and CPMs are cabled together, the hard disk drives are identified in the SAS BIOS screens by slot number instead of the SAS/SATA port number. The identification is as follows:

Slot 0: Local RTM hard disk drive (on the RTM controlling the RAID)

Slot 1: Local HDD AMC hard disk drive

Slot 2: Remote RTM hard disk drive (when a custom crossover cable is used)

Slot 3: Remote HDD AMC hard disk drive (when a custom crossover cable is used)

When a standard crossover cable is used, slots 0 and 1 remain the same but slots 2 and 3 identify an external hard disk drive array.

The slot numbers correspond to the SAS/SATA controller port numbers in [Figure 3 on page 16](#).

6. Complete the array configuration by pressing C.

7. Save the changes when prompted.

Note: When one array has been configured, use the Manage Array option to view, delete, or modify the hot spares in the array. When multiple arrays have been configured, use the View Existing Array option to select and manage an array.

For additional details about using the SAS BIOS screens to create an array, see the [Integrated RAID for SAS User's Guide](#) from LSI Logic Corporation.

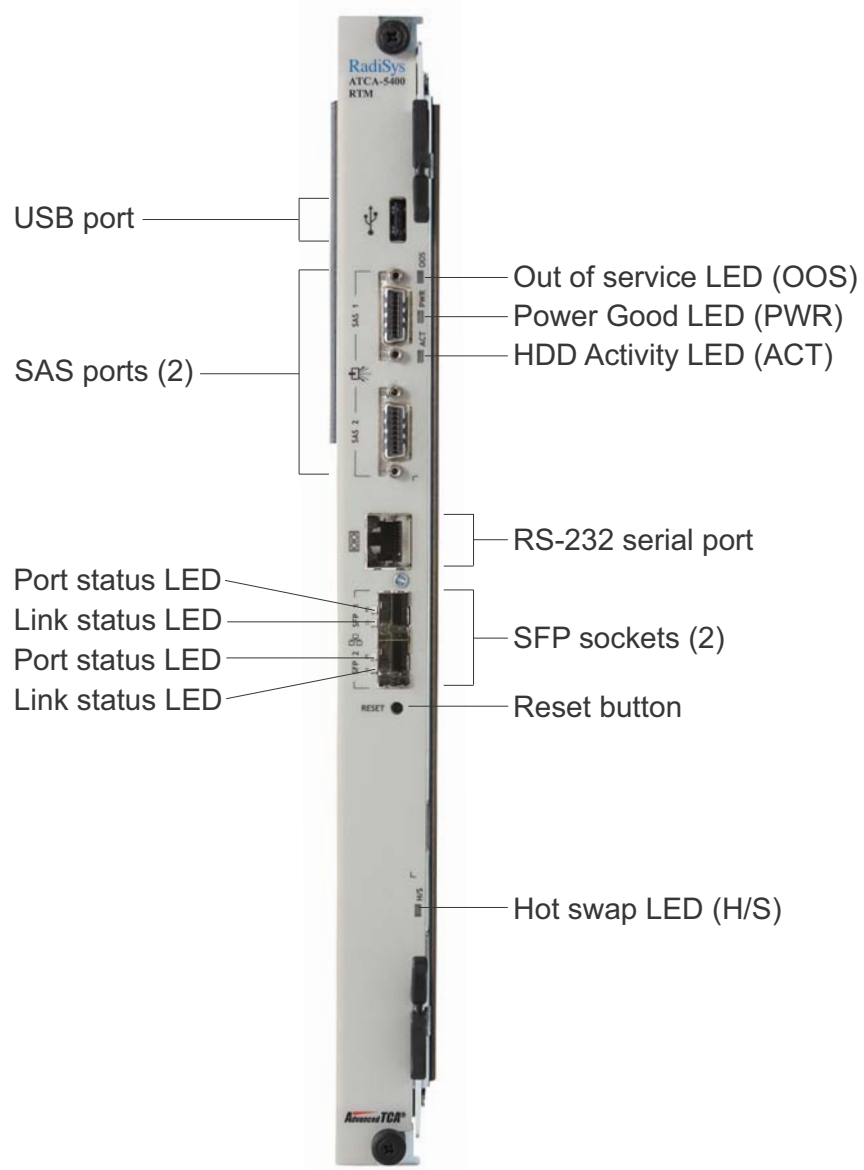
LEDs and External Interfaces

Face plate interfaces

The external interfaces on the RTM face plate include a USB port, two external SAS ports, an RS-232 serial port, two SFP sockets, and a reset button.

Figure 4 shows the location of the interfaces on the RTM face plate.

Figure 4. RTM face plate



LEDs

Table 2 describes the face plate LEDs.

Table 2. Face plate LEDs

Label	LED ID	Definition	Color	LED explanation and states
OOS	LED1	Out of service	Red or amber ^a 	Controlled by the user, so the implementation may vary. ^b - Red or amber: RTM is out of service - Off: RTM is in service
PWR	LED2	Power good	Green 	Controlled by the MMC. - Green: Power to the RTM is normal - Off: RTM is not powered or in the hot-swap process
ACT	LED3	Activity	Amber 	Controlled by the RTM's HDD. - Blinking: HDD activity - Off: No activity
H/S	BLUE LED	Hot swap	Blue 	Controlled by the MMC. - Solid: Ready for hot swap - Long blink: Activating the module after insertion - Short blink: Preparing for hot swap - Off: No hot-swap activity in progress
SFP 1, SFP 2	N/A	Link status	Green or amber 	Controlled by the alarm CPLD over the RTM-link bus. - Green: 1000BASE connection - Amber: 10/100BASE connection (Copper only) - Solid: Link OK - Blinking: Link activity - Off: Link fail, port disabled
		Port status	Green or amber 	Controlled by the OS, ^b so the implementation may vary. Suggested states are: - Solid green: Port enabled - Solid amber: Port in standby mode - Off: Port disabled.

^a The user application can select the LED color using the Set FRU LED State IPMI command. Only red or amber can be selected for the OOS LED.

^b The user application can control LED illumination using the Set FRU LED State IPMI command. LED illumination can be turned on or off, the LED can be configured to blink, or the lamp test function can be enabled. To use the command, specify the FRU ID, LED ID (which is "1" for the OOS LED), LED function, LED on duration, and illumination color. Command usage is described in the PICMG specification, FRU LED Control commands.

Face plate connectors

[Table 3](#) describes the face plate connectors on the RTM:

Table 3. Face plate connectors

Connector	Purpose and usage	Cable type
USB port	Provides USB 2.0 access to the CPM.	USB type A cable.
SAS connector (two)	Extends disk arrays by connecting external hard disks to the RTM. The RTM's SAS/SATA controller can include external disks in a RAID configuration. See Chapter 3, Configuring a Redundant Disk Array, on page 14 .	SFF 8470 SAS crossover cable.
RS-232 serial port	Gives rear management access to the CPM. Configure the external computer's terminal emulator to 11200 Kbps, 8 bits, no parity, 1 stop bit, no flow control.	Console shielded serial cable (RJ-45 to 9-pin D-shell, Radisys order code ATCA-SERIAL-CBL). The same cable is included in shipments of the ATCA-2210 switch and control module.
SFP socket (two)	Supplies two full duplex 1 GbE SerDes connections to the CPM's Ethernet controller. ^a To identify compatible SFP transceivers and install them into the sockets, see Installing SFPs on page 10 .	Straight or crossover double-shielded Cat 5 Ethernet cable.

^a When used with a CPM, the rear ports are not enabled if the CPM front Ethernet ports are configured to be used. See the ATCA-4500, ATCA-4550, ATCA-4555 CPM Reference to configure front or rear port usage.

Important: Radisys requires the use of shielded cables for both serial and Ethernet port connections to minimize the possibility of issues related to external electromagnetic interference (EMI). Ethernet cables should be double-shielded Cat 5. To comply with GR-1089-CORE criteria, if cables are connected to both RTM Ethernet connectors then all cables must be shielded.

Reset button

The RTM face plate includes a reset button, which causes the RTM MMC to issue a cold reset to the CPM's IPMC over the IPMB-L. The IPMC then resets the CPM and the RTM payload.

The reset switch is a recessed button. To push it, use a pen, stylus, or other small pointed object.

Zone 3 interface

Two Zone 3 connectors (P30 and P31) provide the following connections to the RTM:

- Two SAS lanes to provide access to a SAS hard disk drive on the CPM, connected to:
 - AMC Port 2
 - AMC Port 3
- x4 PCIe Gen2 connection from the CPM (which serves the RTM's PCIe Gen1 devices)
- Two 1 GbE SerDes lanes from the CPM Ethernet controller
- One reset input signal to pass a PCI reset from the CPM to the SAS/SATA controller
- Reset button state passed from the RTM through the IPMB-L to the CPM
- Maintenance RS-232 serial port to the CPM
- Two I²C interfaces from the payload Ethernet controller for copper SFP[1:2] SGMII configuration
- IPMB-L interface to the CPM's IPMC
- +12V RTM supply from the CPM
- +3.3V management power from the CPM
- JTAG connectivity for programming and boundary scan testing for all JTAG capable devices

Table 4 and Table 5 show the Zone 3 pinout of the CPM:

Table 4. RTM connector P30 signals

Row	AB		CD		EF		GH	
1	+12V_RTM	+12V_RTM	+12V_RTM	+3.3V_IPMC	RES_STATE	RTM_PRSNT*	RTM_HS_LED	RTM_EN*
2	+12V_RTM	+12V_RTM	+12V_RTM	IPMC_INT*	IPMC_I2C_CLK	IPMC_I2C_DATA	USB_D+	USB_D-
3	SERIAL_0_TX	SERIAL_0_RX	JTAG_TDI	JTAG_TDO	JTAG_TMS	JTAG_TCK	JTAG_TRST*	Future
4	SOCA	SOCB	INT_0	INT_1	RTML_TX	RTML_RX	RTML_CLK	RTM_RESET
5	SERIAL_1_TX	SERIAL_1_RX	SERIAL_2_TX	SERIAL_2_RX	SERIAL_3_TX	SERIAL_3_RX	SERIAL_4_TX	SERIAL_4_RX
6	SERIAL_5_TX	SERIAL_5_RX	SERIAL_6_TX	SERIAL_6_RX	SERIAL_7_TX	SERIAL_7_RX	CPU0_SCL (SMB_SCL)	CPU0_SDA (SMB_SDA)
7	DEBUG_0	DEBUG_1	DEBUG_2	DEBUG_3	RESET_0	RESET_1	RESET_2	RESET_3
8	FE_TXD+	FE_TXD-	FE_RXD+	FE_RXD-	FE_TX_CT	Future	Future	Future
9	SAS0_TX+	SAS0_TX-	SAS0_RX+	SAS0_RX-	SAS1_TX+	SAS1_TX-	SAS1_RX+	SAS1_RX-
10	GE0_TX+	GE0_TX-	GE0_RX+	GE0_RX-	GE1_TX+	GE1_TX-	GE1_RX+	GE1_RX-

Notes:

- Each differential pair has an individual L-shaped ground contact (not shown).
- All signal names are based on the CPM signal names.

Gray indicates unused pins on the CPM

Table 5. RTM connector P31 signals

Row	AB		CD		EF		GH	
1	AMC_17_TX+	AMC_17_TX-	AMC_17_RX+	AMC_17_RX-	AMC_18_TX+	AMC_18_TX-	AMC_18_RX+	AMC_18_RX-
2	AMC_19_TX+	AMC_19_TX-	AMC_19_RX+	AMC_19_RX-	AMC_20_TX+	AMC_20_TX-	AMC_20_RX+	AMC_20_RX-
3	SATA1_RX+	SATA1_RX-	SATA1_TX+	SATA1_TX-	AMC2_18_TX+	AMC2_18_TX-	AMC2_18_RX+	AMC2_18_RX-
4	AMC2_19_TX+	AMC2_19_TX-	AMC2_19_RX+	AMC2_19_RX-	AMC2_20_TX+	AMC2_20_TX-	AMC2_20_RX+	AMC2_20_RX-
5	PCIE1_RX2+	PCIE1_RX2-	PCIE1_TX2+	PCIE1_TX2-	PCIE1_RX3+	PCIE1_RX3-	PCIE1_TX3+	PCIE1_TX3-
6	PCIE1_RX0+	PCIE1_RX0-	PCIE1_TX0+	PCIE1_TX0-	PCIE1_RX1+	PCIE1_RX1-	PCIE1_TX1+	PCIE1_TX1-
7	AMC4_17_TX+ (RESET_7)	AMC4_17_TX- (DEBUG_7)	PCI1_REFCLK+	PCI1_REFCLK-	AMC4_18_TX+	AMC4_18_TX-	PCI0_REFCLK+	PCI0_REFCLK-
8	PCIE0_RX2+	PCIE0_RX2-	PCIE0_TX2+	PCIE0_TX2-	PCIE0_RX3+	PCIE0_RX3-	PCIE0_TX3+	PCIE0_TX3-
9	AMC1_I2C_SCL	AMC1_I2C_SDA	SFP2_SCL	SFP2_SDA	SFP1_SCL	SCP1_SDA	AMC4_I2C_SCL	AMC4_I2C_SDA
10	PCIE0_RX0+	PCIE0_RX0-	PCIE0_TX0+	PCIE0_TX0-	PCIE0_RX1+	PCIE0_RX1-	PCIE0_TX1+	PCIE0_TX1-
Notes:								
- Each differential pair has an individual L-shaped ground contact (not shown). - All signal names are based on the CPM signal names.								
Gray indicates unused pins on the CPM								

Alignment keys

The RTM is mechanically keyed to prevent accidental insertion of the RTM into an incompatible front module. The Zone 2 alignment block (K1) is assigned a keying value of 11. The Zone 3 alignment block (K2) is assigned a keying value of 55.

Components and Subsystems

SAS/SATA controller

The RTM includes an LSI Logic LSISAS1064E, which is a Serial Attached SCSI/Serial Advanced Technology Attachment (SAS/SATA) controller. The controller has four SAS/SATA ports that operate at 3 Gbps and connect to these components:

- The RTM's optional hard disk drive
- The two rear SAS ports
- An AMC installed in the CPM

The controller also supports a PCI Express interface, which can be used as a single x1 or x4 lane to connect the RTM to the CPM.

The controller supports an integrated RAID solution, including RAID levels 0 (disk striping) and 1 (mirroring). The controller is compliant with LSI's Fusion-MPT (message passing technology) architecture for interface controllers. The architecture takes the burden off the host CPU by managing the I/O and consolidating interrupts to reduce system bus overhead. The SAS/SATA controller has integrated transceivers that perform the SerDes conversion necessary for SAS and SATA transfers.

Each of the eight SAS/SATA PHYs on the controller is capable of 3.0 Gbps and 1.5 Gbps SAS and SATA link rates. The controller supports SAS versions 1.0 and 1.1, as well as Serial ATA revision 1.0a.

The controller supports PCI Express receive and transmit data rates of 2.5 Gbps in each direction, yielding a total bandwidth of 5.0 Gbps for each full-duplex lane. The controller supports PCI Express revision 1.0a.

The SAS/SATA controller supports a 32-bit external memory bus. Its external memory controller block provides interfaces to the 2 MB flash ROM and 128 KB NVSRAM that are installed on the RTM to supply boot and RAID journaling functions.

Hard disk drive

The RTM can support a SAS or SATA hard disk drive, which can be purchased from Radisys. The disk must conform to the small form factor (SFF), which is 2.5 inches wide and up to 15 mm in height.

For information on suitable hard disk drives, see the *Component Compatibility Report* in the AdvancedTCA downloads section at www.Radisys.com/downloads. For information on installing the hard disk drive, see *Installing a hard disk drive on page 11*.

Hardware management

The RTM includes a module management controller (MMC), which enables the RTM to provide local IPMC functions for self-control and monitoring. The ability to provide these functions makes the RTM an intelligent FRU. It connects to the CPM's local IPMB and reports events from its managed sensors to the CPM, which sends them to the Shelf Manager.

The MMC subsystem on the RTM consists of a ATmega128 microcontroller and non-volatile (NV) memory. The RTM's MMC is similar to the MMC used on the AMCs, and follows many of the requirements specified in the *PICMG AMC.0 R2.0 Advanced Mezzanine Card Base Specification*. The MMC has the following features:

- Conforms to the "Module Management" section of the PICMG AMC.0 specification
- Sensors and I/O interfaces that can be configured
- A local power input that routes through the IPMC management power (MP) feed from the carrier
- A single I²C management link over Zone 3 IPMB-L pins
- Non-volatile storage for FRU records included inside the microcontroller core
- An MMC enable control through the RTM_ENABLE* pin
- A global payload reset to force payload devices to the reset state
- An MMC internal watchdog timer that provides isolation services and microcontroller fault recovery
- GPIOs for E-Key control
- Reads the module handle switch state
- An MMC console port interface
- A JTAG programming and test interface
- A "soft" I²C port for inlet and outlet temperature sensors
- Drives the standard ATCA LEDs on the RTM for hot swap, service, and power

For information on the IPMI commands the MMC responds to and the sensors it manages, see [Appendix B, IPMI Commands and Managed Sensors, on page 33](#).

Hot swap

The RTM can be hot swapped, and functions as the AMC module does during the hot-swap process. The hot-swap latch status is read by the MMC. Hot swapping means that the RTM can be removed or inserted without shutting down any other part of the CPM or the platform.

Exception: Do not removing the RTM if the CPM has mounted a root file system on:

- The hard disk drive on the RTM
- A SAS hard disk drive on the AMC, because the SAS hard disk drive is accessible only through the RTM SAS/SATA controller
- A remote hard disk drive connected by cable to a SAS/SATA connector on the RTM
- A remote NFS server accessible only through an SFP port on the RTM

WARNING! Do not remove the RTM if the CPM is accessing the operating system via the RTM. The CPM will hang if it loses access to the OS root file system.

See the *ATCA-4500, ATCA-4550, ATCA-4555 CPM Reference* for details about hot swapping the RTM.

Reset

The MMC supports the Cold Reset IPMI command, which can be issued from the CPM (specifying the FRU ID that corresponds to the RTM). See the *ATCA-4500, ATCA-4550, ATCA-4555 CPM Reference* for the correct FRU ID. An RTM reset includes the SAS/SATA controller, the PM8380 multiplexer/link extender, and the alarm CPLD.

To reset both the CPM and the RTM, use the reset button on the RTM face plate as described in [Reset button on page 21](#).

Connectivity records for interface compatibility

The RTM supplies point-to-point connectivity records for several interfaces to let the CPM determine interface compatibility. The CPM may not grant an E-Key to enable its port if the corresponding RTM port is incompatible. The RTM provides connectivity records to describe these interfaces:

- Two SAS ports
- One x1 or x4 PCI-Express port
- Two SerDes gigabit Ethernet ports

The RTM connectivity records comply with the records defined for AMCs in the *PICMG AMC.0 R2.0 Advanced Mezzanine Card Base Specification*.

Upgradeable components

Table 6 summarizes the programmable devices on the RTM and the content that can be upgraded.

Table 6. Programmable devices and upgradeable content

Programmable device	Upgradeable content	Copies to upgrade	Run upgrade commands on
MMC	Runtime code	2	CPM's CPU or remote CPU
	Boot code	1	CPM's CPU or remote CPU
	FRU records	1	CPM's CPU or remote CPU
Alarm CPLD	Firmware	1	CPM's CPU or remote CPU
SAS/SATA controller flash	Controller BIOS	1	CPM's CPU or remote CPU
	Controller firmware	1	CPM's CPU or remote CPU

The RTM upgrades can be performed from the CPM's CPU. The upgradeable content for the RTM is included in the RTM product directory on the Radisys software image, and it is upgraded with the compatible CPM.

Upgrade instructions are included with the software image, which is available from the Radisys Web site at www.Radisys.com/downloads, or from Radisys Support.

WARNING! Do not install the ATCA-5401 Fibre Channel SAS Controller upgrade files onto the ATCA-5400 RTM. The firmware and BIOS files are different between the two products. Updates using the wrong files can render the RTM inoperable.

Specifications

Environmental specifications

The RTM is designed to meet the following environmental specifications. The operating environment must provide sufficient airflow across the module to keep it within its temperature specification.

Table 7. Environmental specifications

Characteristic	State	Value
Temperature (ambient)	Operating	+5° C to +45° C 30° C/hr rate of change
	Short term operating ^a	–5° C to +55° C 30° C/hr rate of change
	Storage	–40° C to +70° C
Relative humidity	Operating	5% to 85% RH non-condensing
	Short term operating ^a	5% to 90% RH non-condensing at +30° C, but not to exceed 0.024 kg water per kg dry air
	Storage	5% to 90% RH non-condensing at +40° C, but not to exceed 0.024 kg water per kg dry air
	Short term storage ^a	5% to 95% RH non-condensing at +40° C, but not to exceed 0.024 kg water per kg dry air
Altitude	Operating	Up to 1800 meters (5,905 feet), +55° C > 1800 meters up to 4000 meters (13,123 feet), derated linearly to +45° C
Shock (drop)	Unpacked Free fall, corners and edges	0 to < 10 kg = 100 mm drop
	Packaged (unpalletized) Free fall, corners, surfaces, and edges	0 to < 10 kg = 1000 mm drop
	Palletized	100 mm free fall drop
Vibration	Operating	0.1 g, 5 to 100 Hz and back, 0.1 octave/min sine sweep ^b
	Transportation (packaged)	0.5 g, 5 to 50 Hz and back, 0.1 octave/min sine sweep ^b 3.0 g, 50 to 500 Hz and back, 0.25 octave/min sine sweep ^b
Seismic	Operating	Per Zone 4 test method, GR-63-CORE

^a Short term defined as a maximum of 96 consecutive hours

^b In each direction for each of three mutually perpendicular axes.

Safety specifications

The safety specifications are measured under laboratory ambient temperature and humidity (approximately 25° C and humidity between 30% and 50%). Testing is performed in partnership with a Nationally Recognized Testing Laboratory (NRTL) accredited to provide the required certifications.

Table 8. Safety specifications

Product safety characteristic	Certification	Standard and test criteria
US	Accessory listing	UL 60950-1 "Safety for Information Technology Equipment"
Canada	Approval	CSA 22.2 #60950-1 "Safety for Information Technology Equipment"
EU	Conformance with the low voltage directive and CB report with group deviations	EN 60950-1 "Safety for Information Technology Equipment"
Other	CB report including all national deviations	IEC 60950-1 "Safety for Information Technology Equipment"

Mechanical dimensions

Table 9. Mechanical specifications

Characteristic		Value
RTM dimensions (with no SFP modules installed)		Approximately 351 mm x 107 mm x 29 mm (13.819" x 4.213" x 1.142")
Board thickness		1.6 mm $\pm$ 0.152 mm (0.063" $\pm$ 0.006")
Weight	RTM without a hard disk drive, sled, or SFPs	596.9 g (21.055 oz)
	Sled and screws for hard disk drive attachment	34 g (1.199 oz)
	Hard disk drive approximate weight range, depending on drive type, vendor, and density	91.6g to 220 g (3.232 oz to 7.76 oz)

Electromagnetic compatibility (EMC)

The module has been evaluated against the following standards while installed in a representative shelf:

Emissions standards

- FCC Part 15 (Class A Digital Device)
- EN 55022:2006 + A1 + A2

Immunity standards

- EN 55024:1998 + A1 + A2
- EN 300 386 V1.4.1

EMC evaluations are all performed under ambient temperature and humidity (at any point between 20° C to 30° C and humidity at any point between 30% and 50%).

Table 10. Electromagnetic Compatibility (EMC)

Emissions		
Characteristic	State	Standard and criteria
Radiated emissions	Operating	FCC Part 15, Class A -6 db EN 55022: 1998, Class A -6 db Note: Testing required to 12 GHz.
Conducted Emissions (DC Power Port)	Operating	EN 300 386, Class A -6 dB Note: The objective is for the combination of CPM and RTM to meet Class B limits with the chassis PEM filtering removed.
Conducted Emissions (Telecommunications ports)	Operating	EN 300 386, Class A -6 dB Shall be performed on copper SFP interface. Objective to also evaluate management FE port

Immunity		
Characteristic	State	Standard and criteria
ESD	Operating	EN 61000-4-2 8 KV direct contact, performance criteria B 15 KV air discharge, performance criteria C
Radiated	Operating	EN 61000-4-3 10 V/m, 80 MHz - 2 GHz, 80% AM, 1 kHz GR 1089 8.5 V/m 10 kHz - 80 MHz, 80% AM, 1 kHz 8.5 V/m 1 GHz - 10 GHz, 1µs, 1 kHz pulse modulation Performance Criteria A

Immunity		
Characteristic	State	Standard and criteria
Fast transient/burst	Operating	EN 61000-4-4 0.5 kV, 5/50 ns, 5 kHz repetition frequency DC power (host chassis), copper SFP interface. Objective to also evaluate management FE and serial ports. Performance criteria B
Surge voltages	Operating	EN 61000-4-5 (CWG - 1.2/50 μ s or 8/20 μ s) Data ports (copper SFP interface. Objective to also evaluate management FE and serial ports) - 1 kV. DC power port (host chassis) - 0.5 kV Performance criteria B
Conducted	Operating	EN 61000-4-6, 0.15 - 80 MHz, 3 vrms 0.01 - 30 MHz, GR 1089 DC power (host chassis), copper SFP interface. Objective to also evaluate management FE and serial ports. Performance criteria A
Magnetic field immunity	Operating	NEN 61000-4-8 — 50 Hz / 1 A/m Performance criteria A

Power consumption

Table 11. RTM power consumption

Product	Maximum power consumption measured at 25°C
RTM with two optical SFP transceivers, using the onboard and AMC hard disk drives, along with the hard disk drives on another RTM/CPM pair	16.2 W

Mean time between failures (MTBF)

- Calculation Type: MTBF/FIT rate
- Standard: Telcordia Standard SR-332 Issue 2
- Methods: Method I, Case III, Quality Level II

The calculation results in [Table 12](#) were generated using the references and assumptions listed. This specification and its associated calculations supersede all other released mean time between failures (MTBF) and failure in time (FIT) calculations with earlier dates. The reported failure rates do not represent catastrophic failure.

Table 12. Reliability estimate data

MTBF at 35°C	Failure rate (FIT) at 35°C
733,000 hours	1364 per 10 ⁹ hours

Environmental assumptions

- Failure rates are based on a 35°C ambient temperature.
- Applied component stress levels are 50% (voltage, current, and/or power).
- Ground, fixed, controlled environment with an environmental adjustment factor equal to 1.0.

General assumptions

- Component failure rates are constant.
- Board-to-system interconnects are included within estimates.
- A hard disk drive is not included in estimates.
- Non-electrical components (screws, mechanical latches, labels, covers, etc.) are not included in estimates.

General notes

- Method I, Case I = Based on parts count. Equipment failure is estimated by totaling device failures rates and quantities used.
- Quality Level II = Devices purchased to specifications, qualified devices, vendor lot-to-lot controls for AQLs and DPMs.

Where available, direct component supplier predictions or actual FIT rates have been used.

IPMI Commands and Managed Sensors

Supported IPMI commands

The RTM supports the IPMI commands in [Table 13](#). See the *Intelligent Platform Management Interface Specification v1.5* for details about these commands. Additional commands may be added in future versions of the firmware.

Table 13. Supported IPMI commands

Message Commands	NetFn	Cmd
Get Device ID	App (0x06)	0x01
Broadcast "Get Device ID"	App (0x06)	0x01
Cold Reset	App (0x06)	0x02
Warm Reset	App (0x06)	0x03
Get Self Test Results	App (0x06)	0x04
Set Event Receiver	S/E (0x04)	0x00
Get Event Receiver	S/E (0x04)	0x01
Platform Event (also called "Event Message")	S/E (0x04)	0x02
Get Device SDR Info	S/E (0x04)	0x20
Get Device SDR	S/E (0x04)	0x21
Reserve Device SDR Repository	S/E (0x04)	0x22
Get Sensor Reading Factors	S/E (0x04)	0x23
Set Sensor Hysteresis	S/E (0x04)	0x24
Get Sensor Hysteresis	S/E (0x04)	0x25
Set Sensor Thresholds	S/E (0x04)	0x26
Get Sensor Thresholds	S/E (0x04)	0x27
Set Sensor Event Enable	S/E (0x04)	0x28
Get Sensor Event Enable	S/E (0x04)	0x29
Get Sensor Event Status	S/E (0x04)	0x2B
Get Sensor Reading	S/E (0x04)	0x2D
Get Sensor Type	S/E (0x04)	0x2F
Get FRU Inventory Area Info	Storage (0x0A)	0x10
Read FRU Data	Storage (0x0A)	0x11
Write FRU Data	Storage (0x0A)	0x12
Get PICMG Properties	PICMG (0x2C)	0x00
Get Address Info	PICMG (0x2C)	0x01
FRU Control	PICMG (0x2C)	0x04
Get FRU LED Properties	PICMG (0x2C)	0x05
Get LED Color Capabilities	PICMG (0x2C)	0x06
Set FRU LED State	PICMG (0x2C)	0x07
Get FRU LED State	PICMG (0x2C)	0x08

Table 13. Supported IPMI commands (continued)

Message Commands	NetFn	Cmd
Get Device Locator Record ID	PICMG (0x2C)	0x0D
Set AMC Port State	PICMG (0x2C)	0x19
Get AMC Port State	PICMG (0x2C)	0x1A
FRU Control Capabilities	PICMG (0x2C)	0x1E
Get Target Upgrade Capabilities	PICMG (0x2C)	0x2E
Get Component Properties	PICMG (0x2C)	0x2F
Abort Firmware Upgrade	PICMG (0x2C)	0x30
Initiate Upgrade Action	PICMG (0x2C)	0x31
Upload Firmware Block	PICMG (0x2C)	0x32
Finish Firmware Upload	PICMG (0x2C)	0x33
Get Upgrade Status	PICMG (0x2C)	0x34
Activate Firmware	PICMG (0x2C)	0x35
Query Rollback Status	PICMG (0x2C)	0x37
Initiate Manual Rollback	PICMG (0x2C)	0x38

Managed sensors

The RTM manages sensors with sensor data record (SDR) support. The RTM implements a Type 12h (0x12) management controller device locator record for identifying the management controller and a Type 1h (0x01) full sensor record for describing the sensor.

Rather than being an actual physical component, some sensors are an accumulation of the information gathered by the measuring devices and the MMC on the RTM. The MMC monitors conditions and detects digital state changes or analog values crossing thresholds. When a transition occurs, the MMC sends the information to the CPM's IPMC, which forwards it to the Shelf Manager as an event. The Shelf Manager may in turn send the event to a system manager.

Types of sensors

The RTM implements the following types of sensors.

- **Discrete** — A discrete sensor can represent up to 16 states. The sensor is coded as a 16-bit value with one bit true and the remaining bits false.
- **Digital** — A digital sensor has two possible states, only one of which can be active at any given time. For example, a digital sensor monitoring the power may indicate whether the power is good (within an acceptable range) or not.
- **OEM** — An OEM sensor is an 8-bit value with its states defined by the manufacturer. The reading types of these sensors are sometimes defined as “sensor-specific.”
- **Threshold** — A threshold sensor has a range of 256 values, which represent measurements on the RTM and its FRUs. Temperature, voltage, current, and fan speed sensors are examples of threshold sensors.

Table 14 shows the threshold definitions.

Table 14. Threshold types

Threshold type	Description
UNR	Upper non-recoverable thresholds generate a critical alarm on the high side.
UC	Upper critical thresholds generate a major alarm on the high side.
UNC	Upper non-critical thresholds generate a minor alarm on the high side.
LNC	Lower non-critical thresholds generate a minor alarm on the low side.
LC	Lower critical thresholds generate a major alarm on the low side.
LNR	Lower non-recoverable thresholds typically generate a critical alarm on the low side.

Supported sensors

Table 15 lists the sensors managed by the MMC.

Table 15. Managed sensors

Number	Name	Type	Reading Type	Normal Reading	Alarm level	Notes					
0	Hot Swap	Module Hot Swap	Sensor Specific Discrete	N/A	N/A	Contains module hot swap information as defined in the AMC.0 Specification					
1	+3.3V MP	Voltage	Threshold	3.30	Minor, Major, Critical	This sensor measures voltage in Volts Hysteresis: 0.06V					
						Default Thresholds					
						LNR	LC	LNC	UNC	UC	UNR
						0.00	3.10	3.16	3.46	3.51	3.60
2	+12V	Voltage	Threshold	12.00	Minor, Major, Critical	This sensor measures voltage in Volts Hysteresis: 0.16V					
						Default Thresholds					
						LNR	LC	LNC	UNC	UC	UNR
						0.06	10.90	11.44	12.61	13.24	13.78
3	Outlet Temp	Temp	Threshold	25	Minor, Major, Critical	This sensor measures temperature in °C Hysteresis: 2.94°C					
						Default Thresholds					
						LNR	LC	LNC	UNC	UC	UNR
						0.05	1.03	2.01	65.71	72.57	80.41
4	Inlet/HDD Temp	Temp	Threshold	25	Minor, Major, Critical	This sensor measures temperature in °C Hysteresis: 2°C					
						Default Thresholds					
						LNR	LC	LNC	UNC	UC	UNR
						0	5	10	45	55	65
5	Version Change	Version Change	Sensor Specific Discrete	N/A	N/A	Reports version changes as defined in the IPMI v2.0 specification					
6	SAS1064E Temp	Temp	Threshold	25	Minor, Major, Critical	This sensor measures temperature in °C Hysteresis: 2°C					
						Default Thresholds					
						LNR	LC	LNC	UNC	UC	UNR
						-10	-5	0	80	90	100
7	+5V	Voltage	Threshold	5.00	Minor, Major, Critical	This sensor measures voltage in Volts Hysteresis: 0.06V					
						Default Thresholds					
						LNR	LC	LNC	UNC	UC	UNR
						0.00	4.75	4.79	5.24	5.27	5.52

Table 15. Managed sensors (continued)

Number	Name	Type	Reading Type	Normal Reading	Alarm level	Notes
8	+3.3V	Voltage	Threshold	3.30	Minor, Major, Critical	This sensor measures voltage in Volts Hysteresis: 0.06V
						Default Thresholds
						LNR LC LNC UNC UC UNR
						0.00 3.12 3.18 3.47 3.50 3.60
9	+1.8V	Voltage	Threshold	1.80	Minor, Major, Critical	This sensor measures voltage in Volts Hysteresis: 0.02V
						Default Thresholds
						LNR LC LNC UNC UC UNR
						0.00 1.70 1.72 1.89 1.90 2.00
10	+1.2V	Voltage	Threshold	1.20	Minor, Major, Critical	This sensor measures voltage in Volts Hysteresis: 0.02V
						Default Thresholds
						LNR LC LNC UNC UC UNR
						0.00 1.12 1.14 1.32 1.33 1.37
11	MMC Reset	OEM	Sensor Specific Discrete	N/A	N/A	Reading Bit Flags
						0x01 - Hard reset 0x02 - Cold reset 0x04 - Warm reset 0x08 - External reset 0x10 - JTAG reset 0x20 - Power fail reset 0x40 - Software reset 0x80 - MMC watchdog reset 0x100 - First boot